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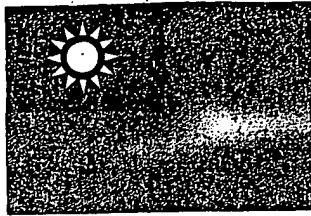
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# 中華民國專利證書

發明第 0八三七九七 號

發明名稱：自動沖洗閥驅動裝置

專利權人：科技概念公司。

發明人：甘尼斯J. 慕德頓克，謝總管。

專利權期間：自中華民國八十五年十二月十一日  
至一〇五年一月七日止

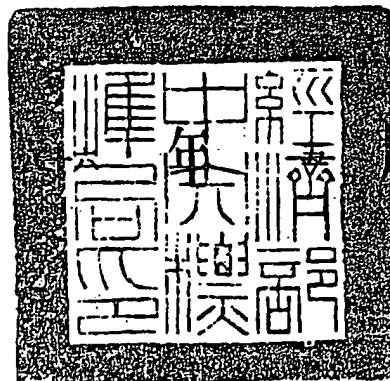
上開發明業經專利權人依專利法之規定取得專利權

經濟部中央標準局  
局長

陳明邦

注意：專利權人未依法繳納年費者，其專利權自原繳費期限屆滿之次日起消滅。

中華民國



十五



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[57]申請專利範圍:

1. 一具有一個沖洗控制柄的沖洗機構之驅動機構包含有:  
一容置架構;  
在上述容置架構中的電池操作驅動機構, 上述的驅動機構係可操作以轉動沖洗控制柄驅動元件於第一非驅動位置以及第二驅動位置之間;  
安裝機構被調整以安裝上述容置架構至上述沖洗機構並且束縛上述容置架構, 使在當上述驅動元件被移動於上述第一位置及上述第二位置之間時能免於相對上述沖洗機構作移動;
2. 如申請專利範圍第1項的驅動機構, 其中上述容置架構包括:  
一電池支持構造;  
電子控制機構, 其係電性連接上述電池支持構造及上述驅動機構以控制上述驅動機構的動作。
3. 如申請專利範圍第2項的驅動機構包

- 括訊號產生機構被電性連接至上述電子控制機構以啟動上述驅動機構在一預定事件發生下的驅動。
4. 如申請專利範圍第3項的驅動機構, 其中上述訊號產生機構包含感測器機構以感測上述沖洗機構相應的衛生設備之使用者的存在與其後離開的狀況。
5. 如申請專利範圍第3項的驅動機構, 其中上述的訊號產生機構係一時序控制機構; 可產生訊號於預定的時間區間。
6. 如申請專利範圍第3項的驅動機構, 其中上述訊號產生機構;  
包含感測器機構以感測上述沖洗機構相應的衛生設備之使用者的存在與其後離開的狀況; 以及  
包含一時序控制機構以產生訊號於預定的時間區間。
- 10.
- 15.

包進包出

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8.如申請專利範圍第1項的驅動機構，其中上述的驅動元件係被上述驅動機構所驅動經過一弧形，介於上述第一非驅動位置及上述第二驅動位置之間

9. 如申請專利範圍第8項的驅動機構，其中上述驅動元件係為一栓，自上述驅動機構橫向延伸。

10.如申請專利範圍第1項的驅動機構，其中上述驅動元件係為一凸輪，受上述驅動機構作用轉動360度。

11.如申請專利範圍第10項的驅動機構，  
包括開關機構以在上述凸輪已轉動  
360度後能停止上述凸輪之轉動。

12. 一種自動驅動衛生設備沖洗機構的沖洗控制柄的裝置，沖洗控制柄自沖洗機構延伸向外，沖洗機構包括與連接沖洗控制柄至沖洗機構的連接元件相鄰的一平坦外表面，及配置介於上述沖洗控制柄和上述沖洗機構之間的一張力裝置以當上述沖洗控制柄自上述第一位置被移動至第二位置時能驅策上述沖洗控制柄回到第一位置，上述之裝置包括：

一容置架權；

在上述容置架構中的電池操作驅動機構，上述驅動機構係可操作以搖動上述沖洗控制柄自上述第一位置至上述第二位置；

感測機構可操作以連接至上述驅動機構來偵測上述衛生設備在有人使用時所產生的訊號以及驅動上述驅動機構以回應上述訊號；

上述容置架構係可移去式地安裝至上述沖洗機構並且具有一鄰接沖洗機構

平坦表面的一邊緣表面以防止上述容置架構相對上述沖洗機構作轉動。

13.如申請專利範圍第12項的裝置，其中  
上述驅動機構包括：

5. 一馬達由上述電池提供電力；  
上述馬達在上述訊號由上述感測機構  
產生時即可操作以連接至沖洗控制柄  
來搖動上述之沖洗控制柄自上述第一  
位置至上述第二位置；

10. 上述張力裝置俟完成沖洗動作即歸返上述沖洗控制柄至上述第一位置。

14.如申請專利範圍第13項的裝置，包括一驅動元件係可操作以連接馬達至沖洗控制柄以及調整以物理性接觸上述之沖洗控制柄；

上述之驅動元件係由上述之馬達俟上述馬達啟動後所搖動。

15. 如申請專利範圍第14項的裝置，其中上述驅動元件被上述馬達以第一方向轉動經一預定的弧形而與上述沖洗控制柄接觸，並被上述張力裝置以第二方向轉動經上述的弧形。

16. 一種衛生設備裝置物之一沖洗槓桿的驅動機構，包括：在封裝內的一電動機械式驅動器，係可操作以嚙合沖洗槓桿者；第一及第二支架半部自電動機械式驅動器的封裝上凸起，大致上圍繞並剛性嚙合使衛生設備裝置物的沖洗槓桿牢固的一軸襯和螺釘帽。

30. 17.如申請專利範圍第16項的驅動機構，其中第一和第二支架半部的相對面包含一與軸襯和螺釘帽之外形互補的幾何形狀。

18.如申請專利範圍第16項的驅動機構，  
進而包含附著機構以將第一及第二支  
架半部偏向在第一以及第二支架半部  
間的軸樑和螺釘帽。

19. 一種用以驅動衛生設備裝置物之沖洗槓桿的裝置，包含：在封裝內的一電動機械式驅動器，係可操作以嚙合沖

5  
洗槓桿者；第一及第二支架半部大致上圍繞並剛性啮合使沖洗槓桿牢固於衛生設備裝置物的一軸襯和六角形螺釘帽；附著機構以將第一及第二支架半部固定至電動機械式驅動器之封裝；以及一電源以供電動機械式驅動器之用。

20. 如申請專利範圍第19項之裝置，其中第一及第二支架半部的相對面包含與軸襯和螺釘帽外形互補的一幾何形狀。

21. 如申請專利範圍第19項之裝置，進而包含機構以將第一及第二支架半部偏向位在第一和第二支架半部中間的軸襯和螺釘帽。

22. 一用於衛生設備沖洗機構之驅動機構的控制裝置包含：

一自給電源；

一感測器以偵測衛生設備之使用；

一與感測器連線的模式選擇器提供相應於感測器動作選定事件的輸出，包括相應於使用者接近以及相應於使用者離開皆有輸出產生的第一模式，僅相應於使用者離開有輸出產生的第二模式，以及相應於每二個使用者使用後離開才有輸出產生的第三模式；以及

機構用以互連接自給電源和驅動機構來回應模式選擇器之輸出。

23. 如申請專利範圍第22項之裝置進而包含時序控制機構以俟衛生設備未使用的時間區間超過時用來致動用以互連接自給電源和驅動機構之機構。

24. 如申請專利範圍第22項之裝置進而包含機構以對於緊接自給電源其中一個和設定按鈕被驅動之後的一設定區間輸出感測器狀態。

25. 如申請專利範圍第23項之裝置進而包含機構以俟每次自給電源及驅動機構互連接時隨即重置該時序控制機構。

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26. 如申請專利範圍第22項之裝置控制裝置進而包含第一封裝且驅動機構包含第二封裝。

27. 如申請專利範圍第22項之裝置，其中控制裝置進而包括含有驅動機構在內的單一封裝。

28. 如申請專利範圍第22項之裝置進而包含機構用以在沖洗區間之後制動連接機構。

10. 圖示簡單說明：

圖1係一沖洗控制閥機構組合的部分切除前正視圖，係經常被發現於人工沖洗衛生單元如洗手間便器設備之類所採之前技者；

15. 圖2係本發明之自動沖洗控制柄驅動機構之一實施例之一視圖，顯示了電源/電路模組、驅動模組，及沖洗控制閥。圖中控制柄驅動機構係在解除驅動的位位置；

20. 圖3係圖2中沖洗控制柄驅動機構之視圖，未包含電源/電路模組且顯示控制柄驅動機構在其驅動位置上；

圖4係本發明之自動沖洗控制柄驅動機構另一實施例之視圖，顯示了電源/電路模組、驅動模組、及沖洗控制閥，控制柄驅動機構係在解除驅動位置；

25. 圖5係圖4沖洗控制柄驅動機構之一視圖，未含電源/電路模組，並顯示控制柄驅動機構在其驅動位置；

30. 圖6係本發明安裝至一標準沖洗機構之自動沖洗控制柄驅動裝置的部分切除外部前端正視圖，特別圖示出與沖洗機構容置架構上之平坦表面相鄰的控制柄驅動裝置容置架構邊緣延伸以固定控制柄驅動裝置免於轉動；

35. 圖7係本發明模組容置架構單元一部分的透視詳細視圖，顯示用以安裝模組容置架構單元至沖洗機構容置架構的支架；

40. 圖8係本發明電源/電路模組的電路

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圖9係本發明在另一實施例下的電源  
電路模組之電路圖；

圖10係本發明又一實施例下的電源/  
電路模組之電路圖。

圖 /

前視

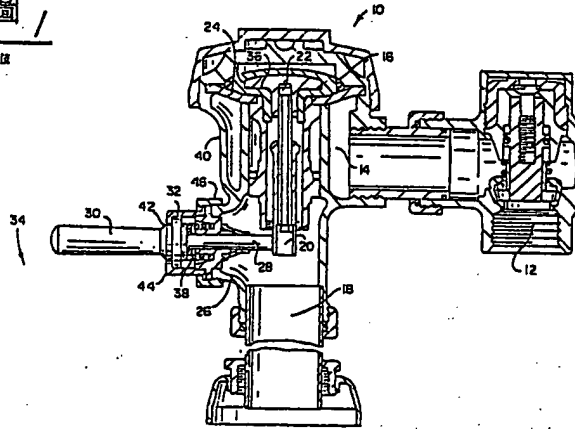


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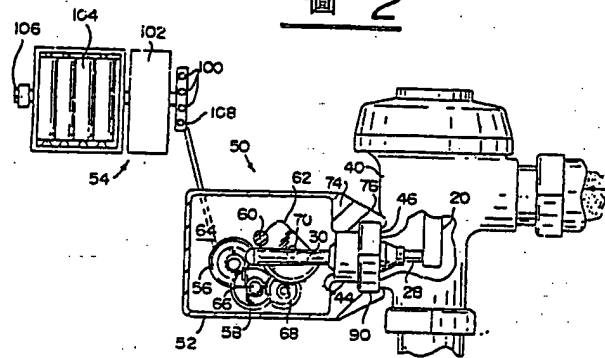
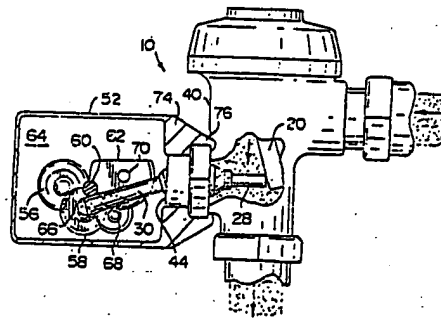


圖 3



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圖 4

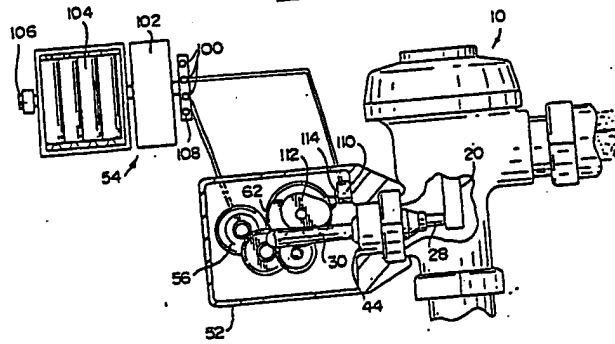


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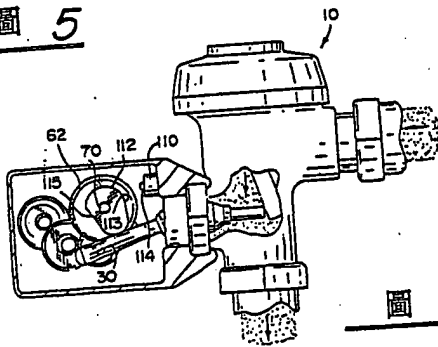


圖 6

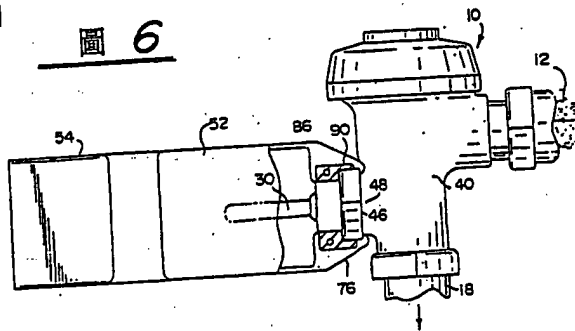


圖 7

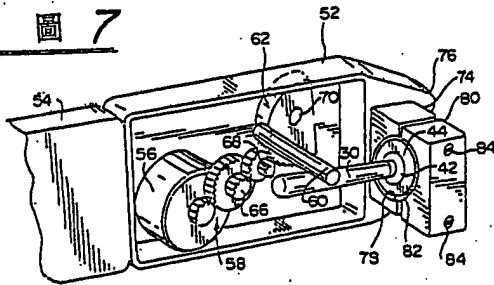


圖9係本發明在另一實施  
電路模組之電路圖;

圖 1  
第 14





AUTOMATIC FLUSH VALVE ACTUATION APPARATUS

5 The present invention relates to automatic flush valve  
actuation devices for toilet and urinal facilities, and in par-  
ticular to add-on flush valve actuation devices that are adapted  
to be readily and easily attached to existing flush valve mecha-  
nisms.

Background of the Invention

10 Public awareness of personal hygiene and water  
conservation issues over the last several years has initiated a  
response by manufacturers of public and private sanitary and  
water use facilities to develop systems that eliminate human  
contact with environmental surfaces that may contain disease  
15 spreading bacteria and to control flush water usage to eliminate  
waste.

Many present toilet and urinal flush devices for  
sanitary facilities are operated by a water control valve  
including a manually operable flush handle adapted to be gripped  
and moved by a user following use of the sanitary facility. A  
20 typical valve arrangement is shown, by way of example, in U.S.  
Patents Nos. 2,776,812 and 3,399,860. However, those valve  
actuation devices present several problems. Among these problems  
are the fact that with an enlightened awareness that public  
sanitary facilities may have been previously used by someone  
25 having a communicable or other disease that is spread upon  
contact, individual users of the sanitary facility are becoming  
reluctant to touch the flush handle and risk becoming ill.  
Therefore, the sanitary facility may remain unflushed, leaving  
30 human waste products in the toilet and urinal, obviously

increasing the unsanitary conditions, and fouling the atmosphere in the facility. Therefore, having flush mechanisms that people won't use can lead to extremely unsanitary and undesirable conditions.

5           In addition, many present flush handle operated valve mechanisms for sanitary devices are constructed such that the user can hold on to the handle for an excessive time period, retaining the valve mechanism in an open position longer than necessary to flush the toilet or urinal. This obviously wastes  
10           water, which can be a major problem in those parts of the world where water is increasingly becoming a scarce commodity. Also, excessive water use leads to additional and unnecessary costs for the entity installing and maintaining the washroom facility.

15           Several systems have been developed in an attempt to address the hygiene and water control problems of existing manual flush control mechanisms for sanitary facilities. These include structures which totally replace the manually operated flush valve mechanism with an automatic, sensor actuated flush valve operation device that is also connected to the 110 volt electrical system extant in the facility. Such a system is shown in  
20           U.S. Patent No. 4,793,88. However, the replacement of existing manually operated flush handle devices with such units is very costly, particularly in buildings such as hotels, office buildings and the like which presently have installed numerous  
25           manually operated flush mechanisms in their sanitary facilities. Such replacement would require the work of mechanical and plumbing personnel, and the installation cost of replacing numerous manually operable flush devices with automatic devices of the type disclosed in U.S. Patent No. 4,793,588 would be  
30           prohibitive. Also, this replacement project would require a shut down of the water supply system or turning off water to the valve until the valve mechanisms could be replaced, which is undesirable in large hotel, office, and other structures. Additionally, building permits would be required for such a replacement  
35           project.

          Another attempt to automatically operate a manual flush valve mechanism for a sanitary facility is shown in U.S. Patent

No. 3,056,143, which discloses a door operated electrical solenoid device for depressing a manual flush handle each time the door to the toilet stall is opened. However, the device shown in Patent No. 3,056,143 has many shortcomings. The  
5 existing valve housing in the prior art structure would have to be disassembled, re-worked and retrofitted to accept the bracket supporting the solenoid. This requires reconstruction of the valve housing. Also, the cantilever nature of the reference mounting structure will result in possible movement of the  
10 bracket upon actuation of the solenoid, and improper actuation of the flush handle. Further, the reference device is tied to the electrical system of the building in which the stall is located, requiring added installation costs. The reference device will operate each time the door opens, whereby the flush  
15 mechanism will operate twice for each use. This waste could be significant, considering that sanitary facilities are operated 4,000 times per month in many installations. Additionally, in the reference device, the existing flush handle remains exposed, whereby the handle can be manually operated or kicked, as some  
20 users are prone to do to avoid touching the handle. This exposure of the handle can also lead to water waste through manual operation.

Therefore, it is an object of the present invention to provide an automatic flush valve actuation apparatus to be  
25 installed and mounted on existing manual flush valve mechanisms without requiring any mechanical work or structural changes to the existing manual flush mechanism.

It is a further object of the present invention to provide an automatic flush valve actuation apparatus which can  
30 be readily mounted to existing flush valve mechanisms, whereby the flush valve actuation apparatus engages a portion of the flush mechanism housing to prevent rotation of the actuation apparatus during operation.

Another object of the present invention is to provide  
35 a battery operated flush valve actuation device for a sanitary unit such as a toilet or urinal, which requires no connection to

the extant electrical system of the installation in which the sanitary unit is located.

5 An additional object of the present invention is to provide an automatically operated actuation device for existing sanitary unit flush handle mechanisms which can be actuated by sensors responsive to use of the facility, and by timing devices that automatically actuate the flush handle at predetermined time intervals.

10 Yet another object of the present invention is to provide an automatically operated flush valve handle actuation device in a compact, self contained unit which can be readily attached to an existing manual flush valve mechanism on existing sanitary units without the need to connect the actuation device to any outside power or control sources.

15 A further object of the present invention is to provide a compact self contained flush valve handle actuation device which is automatically mounted on and aligned with the existing flush valve housing structure, whereby the mounting structure provides the necessary torque to enable the operating mechanism  
20 inside the flush handle actuation device to overcome the spring pressure acting on the flush handle and to depress the flush handle.

#### Summary of the Invention

25 These and other objects and advantages of the present invention are provided in an apparatus for automatically actuating the flush handle of the flushing mechanism of a sanitary device, wherein the flush handle extends outward from the flushing mechanism. The flushing mechanism includes a flat  
30 exterior surface adjacent a connecting element which connects the flush handle to the flushing mechanism. A tension device is disposed between the flush handle and the flush mechanism to urge the flush handle back to a non-flush first position after the flush handle has been moved to a second flush position by the  
35 automatic flush handle actuation mechanism. The present invention provides a compact housing having a battery operated, motor driven flush handle actuation mechanism in the housing

which moves the handle to the second flush position when the motor is activated.

5 A sensor connected to the housing and a timing circuit inside the housing of the present invention, operates the motor upon sensing a use of the sanitary facility to which the housing is attached. The timing circuit also enables the sanitary unit to be flushed at predetermined intervals irrespective of use, where it may be desirable to add and remove anti-bacterial and cleaning agents to the sanitary facility at night when the unit is not being used. The housing is removably mounted to the flushing mechanism and includes a flange surface abutting a flat surface of the flushing mechanism which prevents the housing from rotating or otherwise moving relative to the flushing mechanism to provide the necessary torque to the motor driven handle actuation device inside the housing.

10 In a preferred embodiment of the invention, the flush handle is contacted by a post or hammer type mechanism which rotates through a small arc after the motor is furnished with a short pulse of electrical energy from the batteries. The tension device in the flush mechanism then returns the flush handle and the post or hammer type mechanism to its original or non-flush position.

20 In another preferred embodiment of the invention, a cam device contacts the flush handle, and the cam device rotates through 360 degrees after the motor receives a short pulse of electrical energy from the batteries. A switch and latching circuit then connects the electrical power to the motor, which continues the rotation of the cam. The cam surfaces are designed to initially depress the flush handle, then to allow the tension device of the flush mechanism to raise the handle back to its non-flush position.

30 The present invention is adapted to be readily installed over existing manually operated flush handle mechanisms, without the need to disassemble any of the existing flushing mechanism structure or shut off the water supply. The present device can be installed or removed in a matter of

moments, using simple hand tools, and no external plumbing or electrical connections are required.

By eliminating any intrusion into the valve mechanism itself, the present invention can be mounted onto an existing flushing mechanism without causing the possibility of leaks. Also, the present invention can be installed by a building's present maintenance staff, without the requirement of building permits. The housing of the invention encapsulates the flush handle, thereby isolating the handle from manual use, or kicking. The housing is also stable against rotation and lateral movement relative to the flushing mechanism.

#### Brief Description of the Drawings

FIG. 1 is a cut-away front elevational view of a flush valve mechanism assembly as commonly found in the prior art for manually flushing sanitary units such as toilets, urinals, and the like;

FIG. 2 is a schematic view of one embodiment of the automatic flush handle actuating mechanism of the present invention showing the power/circuit module, the actuating module, and the flush valve, with the handle actuating mechanism in a de-actuating position;

FIG. 3 is a schematic view of the flush handle actuating mechanism of FIG. 2, without the power/circuit module and showing the handle actuating mechanism in its actuation position;

FIG. 4 is a schematic view of another embodiment of the automatic flush handle actuating mechanism of the present invention showing the power/circuit module, the actuating module and the flush valve, with the handle actuating mechanism in a de-actuating position;

FIG. 5 is a schematic view of the flush handle actuating mechanism of FIG. 4, without the power/circuit module, and showing the handle actuating mechanism in its actuation position;

FIG. 6 is an external front elevation partially cut-away view of the automatic flush handle actuation device of the present invention mounted to a standard flushing mechanism,

particularly illustrating the flange extension of the handle actuation device housing which abuts a flat surface on the flushing mechanism housing to hold the handle actuation device against rotation; and

5           FIG. 7 is a perspective detail view of a portion of the modular housing unit of the present invention, showing the brackets for mounting the modular housing unit to the flushing mechanism housing.

10           FIG. 8 is a circuit diagram of the power/circuit module of the present invention.

          FIG. 9 is a circuit diagram of the power/circuit module under an alternate embodiment of the present invention.

15           FIG. 10 is a circuit diagram of the power/circuit module under a second alternate embodiment of the present diagram.

#### Description of the Preferred Embodiment

          Referring to FIG. 1, a flushing mechanism commonly found in the prior art for flushing sanitary units such as toilets and urinals is designated by the numeral 10. Flush water is supplied to the flushing mechanism 10 through an intake port 12, and the water is delivered to a chamber 14 normally closed off by a valve 16. Leading from valve 16 is a water delivery pipe 18 which leads directly to a sanitary unit, such as a toilet or urinal (not shown).

25           The valve 16 includes a stem 20 which extends downward in pipe 18. The upper portion 22 of stem 20 is connected to a tiltable valve operating mechanism 24. The lower portion 26 of stem 20 is adapted to be contacted by a moveable plunger pin 28, which is mechanically connected to a flush handle 30 through a partial ball joint linkage mechanism 32. When flush handle 30 is manually moved through the arc 34 from its first position, shown in FIG. 1, to a second downward position (FIG. 3), plunger pin 28 moves to the right, contacts lower end 26 of stem 20, and tilts stem 20 to the right, as viewed in FIG. 1. This tilting movement of stem 20 causes valve 16 to pivot about point 36, thereby opening water delivery pipe 14 to the passage of flush

water from chamber 14 and through pipe 18, thus flushing the sanitary unit.

5 A tension device, in the form of compression spring 38, is compressed when flush handle 30 is moved through arc 34. When manual pressure on handle 30 is released, spring 38 urges handle 30 back to the position shown in FIG. 1, thereby allowing stem 20 to return to its vertical position and close off valve 16. This halts the flushing operation through pipe 18. It has been determined empirically that a force in the range of four to  
10 eleven pounds is required to move flush handle 30 through arc 34 against the force of spring 38.

Referring to FIGS. 1 and 6, flushing mechanism 10 is encased in a housing 40 which has an opening 42 through which flush handle 30 extends. Opening 42 resides in a circular  
15 bushing 44 which is removably attached to housing 40 by a threaded nut 46. In most instances, nut 46 has a hexagonally shaped outer surface for engagement by an ordinary open-end wrench. Housing 40 includes a pair of external front and back flat portions 48 (FIG. 6) which form part of the casing comprising housing 40. In FIG. 6, only the front flat portion 48 is  
20 visible. The back flat portion of the housing is directly behind the front flat portion 48 shown in FIG. 6.

One preferred embodiment of the automatic flush handle actuation device of the present invention is illustrated in FIGS.  
25 2, 3 and 6, and is designated generally by the numeral 50. The flush handle actuation device 50 is comprised of two major components, i.e.: a modular housing unit 52 and a power/circuit module 54. The housing unit 52 is adapted to be easily mounted onto flushing mechanism housing 40 over flush handle 30 in a  
30 manner to be explained. Internally of modular housing unit 52 is a motor 56 which is mechanically connected through a reduction gear train 58 to an actuating element (pin 60) which is mounted on gear 62 of reduction gear train 58. As motor 56 is activated, gear train 58 rotates gear 62 in a counter-clockwise direction,  
35 as viewed in FIG. 2. Pin 60 moves downward, contacting flush handle 30, and moving flush handle 30 downward to the position shown in FIG. 3. This moves plunger pin 28 to the right, tilting



stem 20 and activating flush mechanism 10. As will be explained in further detail, compression spring 38 (FIG. 1) returns flush handle 30 to the position shown in FIG. 2 after power to motor 56 is cut off.

5 Motor 56 is rigidly mounted to a side wall 64 of housing 52. Likewise, the elements of gear train 58 are rotatably mounted on shafts having axes 66, 68 and 70, which are rigidly mounted on side walls 64 of housing 52. Any reverse torque applied by spring 38 through flush handle 30 during  
10 operation of motor 56 and movement of the flush handle from the position shown in FIG. 1 to the position of FIG. 3 is resisted by pin 60, gear train 58 and motor 56 acting through housing 52. For that reason, the present invention provides a rigid, while readily removable mounting structure between modular housing unit  
15 52 and flushing mechanism housing 40.

To this end, referring to FIGS. 1, 2, 6 and 7, modular housing unit 52 includes a cradle-shaped mounting bracket rigidly attached near one end of housing 52 which is to be attached to flushing mechanism housing 40. A flange portion 76 (FIG. 7)  
20 extends from housing unit 52 beyond the location of bracket 74. Bracket 74 includes a semi-circular cut-out portion 78 adapted to fit around half of the outside portion of bushing 44. A separate bracket 80 having a semi-circular opening 82 is provided to engage bracket 74 such that opening 82 extends around the  
25 remaining half of bushing 44 when modular housing 52 is mounted on flushing mechanism housing 40. A pair of screws 84 are provided to readily allow bracket 80 to be attached to bracket 74 by use of an ordinary screwdriver.

As best seen in FIG. 6, when brackets 74 and 80 mount  
30 modular housing 52 to flushing mechanism housing 40, flange 76 extends over and engages the back flat surface 48 of housing 40, thereby preventing modular housing 52 from rotating relative to flushing mechanism housing 40. The inside of brackets 74 and 80 include a cut-out portion 90 in the shape of hexagonal nut 46,  
35 which cut-out portion engages the outer surface of nut 46 and also assists in preventing rotation of modular housing 52 relative to flushing mechanism housing 40. A further cut out

portion 86 in brackets 74 and 80 are configured to engage circular bushing 44 to further assist in rigidly mounting modular housing 52 to flushing mechanism housing 40.

5        Operation of the automatic flush handle actuation device 50 occurs under any of a number of predetermined events. One such event is use of the sanitary unit. Another event may be non-use of the sanitary unit for some predetermined time period. Upon the occurrence of one of the predetermined events, a signal generating means activates the automatic flush handle  
10        actuation device 50.

Referring to FIG. 2, one signal generating means includes a sensor for detecting use of the sanitary facility. The sensor may be a motion detector 100, infra-red sensor, or a body heat detector. Upon detection of use by the sensor, an  
15        electronic control means (circuit board 102) inter-connected between a power source 104 and drive mechanism 50 within the modular housing unit 52 provides a pulse of electrical energy to the motor 56 of such duration as to rotate the gear 62 through a predetermined arc, at which point the motor stalls. At the end  
20        of this arc, power to motor 56 is cut off, and spring 38 raises handle 30 upward to its closed position. Pressure on pin 60 causes gear 62 to rotate clockwise from the position shown in FIG. 3 to the position shown in FIG. 2. In the preferred embodiment, power source 104 constitutes one or more battery units  
25        (four shown), whereby no outside electrical power is required to operate motor 56.

Other signal generating means include a user button 106 or an interval timer on circuit board 102 set to activate the automatic flush handle actuation device 50 during the evening  
30        hours when use of the sanitary unit would be infrequent. In the case of the interval timer, a day/night sensor 108 may be provided to deactivate the timer during daytime hours.

Control of the automatic flush handle activation device 50 under an embodiment of the invention can be best understood  
35        by reference to the circuit diagram of FIG. 8 and by reference to the parts list of TABLE 1:

---

TABLE 1

5	IC1:	PC74HC74, CMOS, PHILIPS OR EQUIVALENT
	IC2:	N74HC04, CMOS, MITSUBISHI OR EQUIVALENT
	IC3,8:	PC74HC74, CMOS, PHILIPS OR EQUIVALENT
	IC4:	HD74HC02, CMOS, HITACHI OR EQUIVALENT
10	IC5,6,7:	HD4HC00, CMOS, HITACHI OR EQUIVALENT
	IC9:	BJ-101, CMOS ASIC, HOLTEK MICRO ELECTRONICS
	IC10:	7044A, 4.4V VOLTAGE DETECTOR, HOLTEK MICRO ELECTRONICS
	IC11:	1033, 3.3V VOLTAGE DETECTOR, HOLTEK MICRO ELECTRONICS
	D1:	INFRARED PHOTO DIODE
15	D2,3:	INFRARED EMITTING DIODE, 5MM DIAMETER
	D4:	RED LED, 5MM DIAMETER
	D5:	GREEN LED, 5MM DIAMETER
	D6-15:	IN414148 SWITCHING DIODE
	Q1,3,4:	2SC945 NPN TRANSISTOR OR EQUIVALENT
20	Q2:	2SA733 PNP TRANSISTOR OR EQUIVALENT
	Q5:	2SB562 PNP TRANSISTOR OR EQUIVALENT
	Q6:	2SD965 NPN TRANSISTOR OR EQUIVALENT

---

25           Activation of the motor 56 of FIG. 8 under a preferred embodiment occurs upon receipt of an activation signal from either of two possible signal sources: (1) an output from a motion sensing detector 100 indicating use of the sanitary  
30 facility; or (2) an output of a timer 200. An output from either source results in an activating signal to the motor 56 through a controlling "NOR" gate 201.

          For the motor 56 to remain in a deactivated state, the controlling NOR gate 201 must have a logical 0 on each input.  
35 A logical 0 at both inputs of NOR gate 201 results in a logical 1 at the output of the NOR gate 201 and a 0 at the output of the inverter 202. A 0 at the output of the inverter 202 causes transistors Q4 and Q5 to remain in a non-conductive state resulting in no voltage being applied to the motor 56.

40           A logical 0 at both inputs of the NOR gate 201 causes a capacitor C1 of a resistor-capacitor (RC) timing circuit, R1 and C1, to charge to a supply voltage value (3.3V). The momentary application of a positive-going pulse to either input of the NOR gate 201 causes the capacitor C1 of the RC timing  
45 circuit to rapidly discharge to 0. A logical 0 at capacitor C1 and at the input to the inverter 202 causes the activation of the

motor 56 through transistors Q4 and Q5. The time of activation of the motor 56 is determined by the charging time of the RC timing circuit R1, C1 after the input of the NOR gate 201 has returned to 0.

5           The occasion for the generation of the positive-going pulse at the input of the NOR gate 201 from the sensor 100 is determined by the state of mode switches S1 and S2. When the mode switches S1, S2 are in the state shown in FIG. 8 (sanitary mode), the motor 56 will be activated both when a user approaches  
10           the sanitary facility and when the user leaves the sanitary facility. When only switch S1 is closed (normal mode) the motor 56 will be activated only once for each use of the sanitary facility. When only switch S2 is closed, the motor 56 will only be activated after every other use of the sanitary facility.

15           With switches S1 and S2 in the sanitary mode (S1 and S2 as shown in FIG. 8), a logical 0 is applied to one input of NAND gate 204 due to the open state of the switch S2 and because resistor R10 pulls the input to a very low value. The 0 at one input of the NAND gate 204 blocks the passage of any control  
20           signals from the sensor 100 through the NAND gate 204. Conversely, the logical 0 from switch S2 causes a logical 1 on NAND gate 205 through inverter 206. The logical 1 on one input of NAND gate 205 allows the passage of control signals from the sensor 100 to the controlling NOR gate 201 through NAND gates 203, 205 and 208.

25           With the sensor 100 in a deactivated state, a logical 0 is maintained on interconnect 210. The logical 0 on interconnect 210 results (after a time period) in logical 0's on the inputs of inverters 209 and 211 as well. The logical 0's on the inputs of inverters 209 and 211 causes logical 1's to be applied  
30           to the inputs of NAND gate 208 and, consequently, a logical 0 at the input of the controlling NOR gate 201.

          Upon the activation of the sensor 100, caused by the approach of a user to the sanitary facility, the interconnect 210 rises to a logical 1. The change of interconnect 210 to a  
35           logical 1 causes a negative-going pulse to emanate from the output of inverter 211. The negative-going pulse is transferred to the controlling NOR gate 201 causing activation of the motor

56 through NAND gates 208, 205 and 203. The duration of the negative-going pulse from inverter 211 is determined by resistance and capacitance values of a second RC timing circuit R2, C2.

5 Likewise, when the user of the sanitary facility leaves (causing deactivation of the sensor 100), a second negative-going pulse emanates from the output of inverter 209. The duration of the second negative-going pulse is determined by resistance and capacitance values of the third RC timing circuit R3, C3.

10 When the switches S1, S2 of the automatic flush handle activation device 50 are changed to the normal mode (S1 closed; S2 open), the first negative-going pulse is dissipated across resistor R4 into the power supply (3.3V) through switch S1. Placing the automatic flush valve activation device 50 in the  
15 normal mode causes the motor 56 to be activated only once for each use of the sanitary facility (when the user walks away thereby causing the sensor 100 to become deactivated) by a negative-going pulse from inverter 209 through NAND gates 208, 205, 203.

20 When the automatic flush handle activation device 50 is placed in the water saver mode (S2 closed), the motor 56 is activated (sanitary facility flushed) only after every other use of the sanitary facility. Activation of the motor 56 after every other use is accomplished by rerouting the activation signal from  
25 a path through NAND gates 208, 205 and 203 to a path through NOR gate 207 and NAND gates 204 and 203. Rerouting is accomplished by placing a logical 1 on one input of NAND gate 204 through switch 52 and by placing a logical 0 on NAND gate 205 through use of switch 52 and inverter 206. The application of a logical 0  
30 on one input of NAND gate 205 blocks signal flow through NAND gate 205. The application of a logical 1 to one input of NAND gate 204 allows signal flow through NAND gates 204 and 203 from NOR gate 207.

35 NOR gate 207 provides a logical 1 output only when both input signals become a logical 0. Inverter 209, as explained above, provides a negative-going pulse each time the sensor transcends to a deactivated state. D flip-flop 212, on the other

hand, toggles between a set and a reset state each time the sensor 100 is activated. Each time the flip-flop 212 is in a reset state when the sensor 100 is activated, the output of the flip-flop 212 (logical 1) blocks (at NOR gate 207) the negative-going pulse from inverter 212. The net result of blocking every other pulse is that whenever the switch S2 is closed, the motor 56 is activated (sanitary facility flushed) only once for each two uses of the sanitary facility.

Turning now to the timing circuit 200, an output activating the motor 56 is provided at the controlling NOR gate 201 from the timing circuit 200 every four hours. The output is provided by dividing a 75 kilo Hertz (kHz) signal within  $2^{10}$ ,  $2^5$  and  $2^{15}$  counters. The 75 kHz signal is generated by an oscillator consisting of the  $2^{10}$  counter and a resistance-capacitance network R5, C5. The 75 kHz signal is reduced in frequency within the  $2^{10}$  and  $2^5$  counters of timer circuit 200 and routed through NAND gates 215 and 213 before being reduced to a four hour signal within the  $2^{15}$  counter of the timer circuit 200.

Upon insertion of batteries into the power unit 104 of the automatic flush handle activation device 50, a D flip-flop 216 is placed into a set state by the interaction of a capacitor C6 and a resistor R6. Placing the D flip-flop 215 into a set state provides a calibration interval (7.5 minutes) for adjustments to a variable resistor, VR1, controlling the sensitivity of the sensor 100. During normal operation, adjustments may be made to the sensitivity of the sensor 100 by pushing a calibration button S3.

During the calibration interval, a Logical 0 on the  $\bar{Q}$  output of the D flip-flop 216 blocks signals passing from the  $2^5$  counter to the  $2^{15}$  counter at NAND gate 215. A logical 1 on the Q output of the D flip-flop 216 allows a signal to pass directly from the  $2^{10}$  counter to the  $2^{15}$  counter via NAND gates 214 and 213. An output of the  $2^{15}$  counter is then applied to a toggle input resetting D flip-flop 216 after 7.5 minutes.

To aid in the calibration of the sensor 100 during the calibration interval, a light emitting diode (LED) D4 provides visual indication that a user is within range of the sensor 100.

A negative-going pulse, B, caused by activation of the sensor 100 is gated during the calibration interval by the Q output of the D flip-flop 216 to the LED D4 via inverter 228 and NAND gates 216, 217 and 220. After the calibration interval, a second output, A, providing visual indication from the sensor 100 is gated to the LED D4 by the  $\bar{Q}$  output of the D flip-flop 216 via NAND gates 219, 217 and 220.

Operation of the sensor 100 is facilitated through use of two infrared transmitters D2, D3. A 2.27 Hz signal from an output of the 2<sup>5</sup> counter of the timing circuit 200 is divided in half within a D flip-flop 221 and is shaped within an RC network, R7, C7 before application to transmitting diodes D2, D3 via transistor Q6.

When a user approaches the sanitary facility, infrared light from the transmitting diodes D2, D3, reflected from the user is detected by the sensor 100 and amplified by transistors Q1-Q3. The amplified signal is then shifted across shift registers 221-226 by the 1.15 Hz signal 227 also applied to the transmitting diodes D2, D3. Output signals from the sensor 100 are expanded and delayed within the shift register 221-226 before application to the interconnect 210 via diodes D6-D8.

Control of the automatic flush handle activator device 50 under an alternate embodiment may be understood by reference to the circuit diagram of FIG. 9. The motor 56 of the modular housing unit 52 as described above may be activated by any one of three possible events: (1) activation by a user of the user button 106; (2) activation of a motion sensor 100; or (3) expiration of a time interval programmed into the interval timer TR2 (FIG. 9). The interval timer may be used during extended periods of inactivity (e.g. every two hours) to activate the flushing mechanism 50. After each event, a normally-closed contact CR1 would reset the timer TR2 for activation after another interval.

Following activation of the motor 56 by a signal generating means, a bridging contact CR1 is closed across the signal generating means electric contact (FIG. 9) to maintain power on the motor 56 for sufficient time for the gear 62 of the reduction

gear train 58 to rotate through its predetermined arc. Cycle timer TR1 is programmed to allow sufficient time for such rotation before deactivating the motor 56. Rotation of the gear 62 through the predetermined arc allows the pin 60, attached to the gear 62, to move the flush handle 30 from a first position (FIG. 2) to the second position (FIG. 3). As the flush handle 30 moves to the second position (FIG. 3), the cycle timer TR1 times out, deactivating the motor 56, and allows the spring 38 within the flushing mechanism 10 to return the flush handle 30 to the first position (FIG. 2) as described above, since motor 56 is deactivated.

In another embodiment of the invention (FIGS. 4 and 5), a position sensor 110 (e.g., a limit switch or proximity detector) is used to determine a rotational position of the gear 62. In addition, an actuating element consisting of a cam 112 is rigidly attached to the gear 62 on shaft axis 70 for moving the flush handle 30 between the first position (FIG. 4) and the second position (FIG. 5).

When motor 56 is activated, gear 62 and cam 112 rotate in a counter-clockwise direction. The surface 113 (FIG. 5) of cam 112 is designed such that partial rotation of the cam will move flush handle 30 from the position shown in FIG. 4 to the position shown in FIG. 5, thereby flushing the sanitary unit to which the flushing mechanism 10 is attached. As cam 112 continues to rotate counter-clockwise, flush handle 30 comes into contact with flat surface 115 of cam 112, and the flush handle moves back to the position shown in FIG. 4 under the influence of spring 38 (FIG. 1). Cam 112 and gear 62 continue to rotate until they reach the position shown in FIG. 4, when rotation is halted by the control elements provided in circuit board 102, which also sets the operating components for the next flushing operation.

Rotational positioning of the gear 62 and cam 112 is provided by a sensor activating element 114 rigidly mounted to the periphery of the gear 62. When the gear 62 is in the first position (FIG. 4) the position sensor 110 is activated by the sensor activating element 114. When the gear 62 rotates out of



the first position the position sensor 110 becomes deactivated until the gear 62 (and sensor activating element 114) again returns to the first position.

5 FIG. 10 is an alternate embodiment circuit diagram of the power/circuit module 54 of the embodiment of FIGS. 4 and 5. The two contacts of the position sensor 110 (normally-open and normally-closed) of FIG. 10 are shown in the deactivated state (sensor activating element 114 not activating the position sensor 110).

10 As shown in FIG. 10, whenever the position sensor 110 is deactivated by movement of sensor activating element 114 away from the position sensor 110, the motor 56 will continue to rotate until the sensor activating element 114 again engages the position sensor 110. Events that will cause the position sensor  
15 110 to become deactivated include: (1) activation of the user button 106; (2) activation of the motion sensor 100; or (3) time-out of the timer TR2. Upon deactivation of the position sensor 110 because of any of the three events, the gear 62 and cam 112 will rotate through one complete revolution. Where deactivation  
20 of the position sensor 110 is caused by time-out of the timer TR2, the rotation of the cam 112 will also reset the timer TR2 through operation of the normally open set of position sensor 110 contacts.

As demonstrated, the automatic flush handle activation  
25 device of the invention provides an easy-to-install, reliable means of flushing sanitary devices without direct user intervention. Such means is provided without the help of a skilled craftsman or outside power sources. The use of a two-piece coupling member allows the automatic flush handle activation  
30 device to be attached to existing plumbing fixtures without concern for service interruptions or damage to the existing plumbing fixtures due to twisting forces inherent in prior art devices. Also, the two-piece coupling member allows the flush handle activation device of the present invention to be easily  
35 removed and replaced, if necessary.

The foregoing specification describes only the preferred embodiments of the invention as shown. Other embodi-

ments besides the ones described above may be articulated as well. The terms and expressions, therefore, serve only to describe the invention by example only and not to limit the invention. It is expected that others will perceive differences  
5 which, while differing from the foregoing, do not depart from the spirit and scope of the invention herein described and claimed.

I claim:

1. A drive mechanism for a flushing mechanism having a flush handle comprising:

a housing;

5 battery operated drive means in said housing, said drive means operable to move a flush handle actuating element between a first non-actuating position and a second actuating position;

10 mounting means adapted to mount said housing to said flushing mechanism and restrain said housing against movement relative to said flushing mechanism when said actuating element is moved between said first position and said second position.

2. The drive mechanism of claim 1 wherein said housing includes:

a battery support structure;

5 electronic control means electrically connected between said battery support structure and said drive means to control the operation of said drive means.

3. The drive mechanism of claim 2 including signal generating means electrically connected to said electronic control means to initiate actuation of said drive means upon the occurrence of a predetermined event.

4. The drive mechanism of claim 3 wherein said signal generating means comprise sensor means which sense the presence and subsequent absence of a user of a sanitary device with which said flushing mechanism is associated.

5. The drive mechanism of claim 3 wherein said signal generating means is a timing mechanism which generates signals at predetermined time intervals.

6. The drive mechanism of claim 3 wherein said signal generating means:

5 comprises sensor means which sense the presence and subsequent absence of a user of a sanitary device with which said flushing mechanism is associated; and

comprises a timing mechanism which generates signals at predetermined time intervals.

7. The drive mechanism of claim 1 wherein said mounting means includes a flange surface extending from said housing and adapted to contact said flushing mechanism when said housing is mounted to said flushing mechanism.

8. The drive mechanism of claim 1 wherein said actuating element is driven by said drive means through an arc between said first non-actuating position and said second actuating position.

9. The drive mechanism of claim 8 wherein said actuating element is a pin extending laterally from said drive means.

10. The drive mechanism of claim 1 wherein said actuating element is a cam rotated through 360 degrees by said drive mechanism.

11. The drive mechanism of claim 10 including switch means to stop said cam from rotating after said cam has rotated 360 degrees.

12. An apparatus for automatically actuating the flush handle of the flushing mechanism of a sanitary device, the flush handle extending outwardly from the flushing mechanism, the flushing mechanism including a flat exterior surface adjacent a connecting element connecting the flush handle to the flushing mechanism, and a tension device disposed between said flush handle and said flushing mechanism to urge said flush handle back to a first position when said flush handle is moved to a second position from said first position, said apparatus comprising:

10 a housing,  
battery operated drive means in said housing, said drive means operable to move said flush handle from said first position to said second position;

15 sensing means operably connected to said drive means to detect a signal generated upon use of said sanitary device and actuate said drive means in response to said signal;

20 said housing removably mounted to said flushing mechanism and having a flange surface abutting the flat surface of the flushing mechanism preventing said housing from rotating relative to said flushing mechanism.

13. The apparatus of claim 12 wherein said drive means includes:

a motor powered by said batteries,  
said motor operably connected to the flush handle to  
5 move said flush handle from said first position to said second  
position upon generation of said signal by said sensing means;  
said tension device returning said flush handle to said  
first position upon completion of a flushing operation.

14. The apparatus of claim 13 including an actuating  
element operably connecting the motor to the flush handle and  
adapted to physically contact said flush handle;  
said actuating element moved by said motor upon  
5 activation of said motor.

15. The apparatus of claim 14 wherein said actuating  
element is rotated in a first direction through a predetermined  
arc by said motor into contact with said flush handle, and is  
rotated through said arc in a second direction by said tension  
5 device.

16. A drive mechanism for a flush lever of a sanitary  
fixture comprising: an electromechanical actuator, within an  
enclosure, operably engaging the flush lever; first and second  
bracket halves projecting from the electromechanical actuator  
5 enclosure, substantially enclosing and rigidly engaging a bushing  
and nut securing the flush lever to the sanitary fixture.

17. The mechanism as in claim 16 wherein opposing faces of  
the first and second bracket halves comprise a complementary  
topography to the bushing and nut.

18. The mechanism as in claim 16 further comprising attach-  
ment means for biasing the first and second bracket halves  
against the bushing and nut between the first and second bracket  
halves.

19. An apparatus for activating a flush lever of a sanitary  
fixture comprising: an electromechanical actuator, within an  
enclosure, operably engaging the flush lever; first and second  
bracket halves substantially enclosing and rigidly engaging a  
5 bushing and hexagonal nut securing the flush lever to the  
sanitary fixture; attachment means for securing the first and  
second bracket halves to the electromechanical actuator enclo-  
sure; and a power source for the electromechanical actuator.

20. The mechanism as in claim 19 wherein opposing faces of the first and second bracket halves comprise a complementary topography to the bushing and nut.

21. The mechanism as in claim 19 further comprising means for biasing the first and second bracket halves against the bushing and nut located between the first and second bracket halves.

22. A control apparatus for a drive mechanism of a flushing mechanism of a sanitary facility comprising:

a self-contained power source;

a sensor for detecting use of the sanitary facility;

5 a mode selector interconnected with the sensor providing an output upon selected events of sensor operation including a first mode where an output occurs both in response to approach of a user and in response to withdrawal of the user, a second mode where an output occurs in response to withdrawal  
10 of the user, and a third mode where an output occurs in response to withdrawal of every second user; and

means for interconnecting the self-contained power source and drive mechanism in response to the mode selector output.

23. The apparatus as in claim 22 further comprising timing means for activating the means for interconnecting upon expiration of a time interval of non-use of the sanitary facility.

24. The apparatus as in claim 22 further comprising means for outputting sensor status for a set-up interval first following activation of one of the self-contained power source and a set-up button.

25. The apparatus as in claim 23 further comprising means for resetting the timing means upon each [occurrence of] interconnection of the self-contained power source and drive mechanism.

26. The apparatus as in claim 22 wherein the control apparatus further comprises a first enclosure and the drive mechanism comprises a second enclosure.

27. The apparatus as in claim 22 wherein the control apparatus further comprises a single enclosure also containing the drive mechanism.

28. The apparatus as in claim 22 further comprising means for deactivating the means for interconnecting after a flush interval.

# ABSTRACT

5 A drive mechanism for a flushing mechanism having a  
flush handle including a housing with a battery operated drive  
system in the housing. The drive system has an actuating element  
which is operably connected to the flush handle, which is encased  
in the housing, whereby the drive system operates the flush  
handle between a first non-actuating position and a second flush  
10 actuating position. The housing is removably mounted to the  
flushing mechanism such that the housing is restrained against  
movement relative to the flushing mechanism when the actuating  
element is moved between its first and second position.